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Ishii

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(54) **FEEDING DEVICE AND IMAGE FORMING APPARATUS**

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(51) **Int. Cl.**
B65H 1/00 (2006.01)

(52) **U.S. Cl.** **271/171**; 271/9.01

(58) **Field of Classification Search** 271/171, 271/145, 9.01, 9.08, 9.09, 9.13, 162; 399/393
See application file for complete search history.

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(57) **ABSTRACT**

A feeding device includes a body having a sheet placement surface on which a sheet that is to be fed is placed; a cover rotatably provided at the body and supporting a back edge portion in a feeding direction of the sheet placed on the sheet placement surface when the cover is open; a moving member provided at the sheet placement surface so as to be movable in a direction parallel to the feeding direction; a linking member extending in a movement direction of the moving member from the moving member, one end portion thereof being rotatably linked to the moving member using a rotary shaft that is parallel to a rotary shaft of the cover; and a sheet back-edge regulating member provided at the linking member so as to be movable in the movement direction, and regulating a back edge in the feeding direction of the sheet.

10 Claims, 14 Drawing Sheets

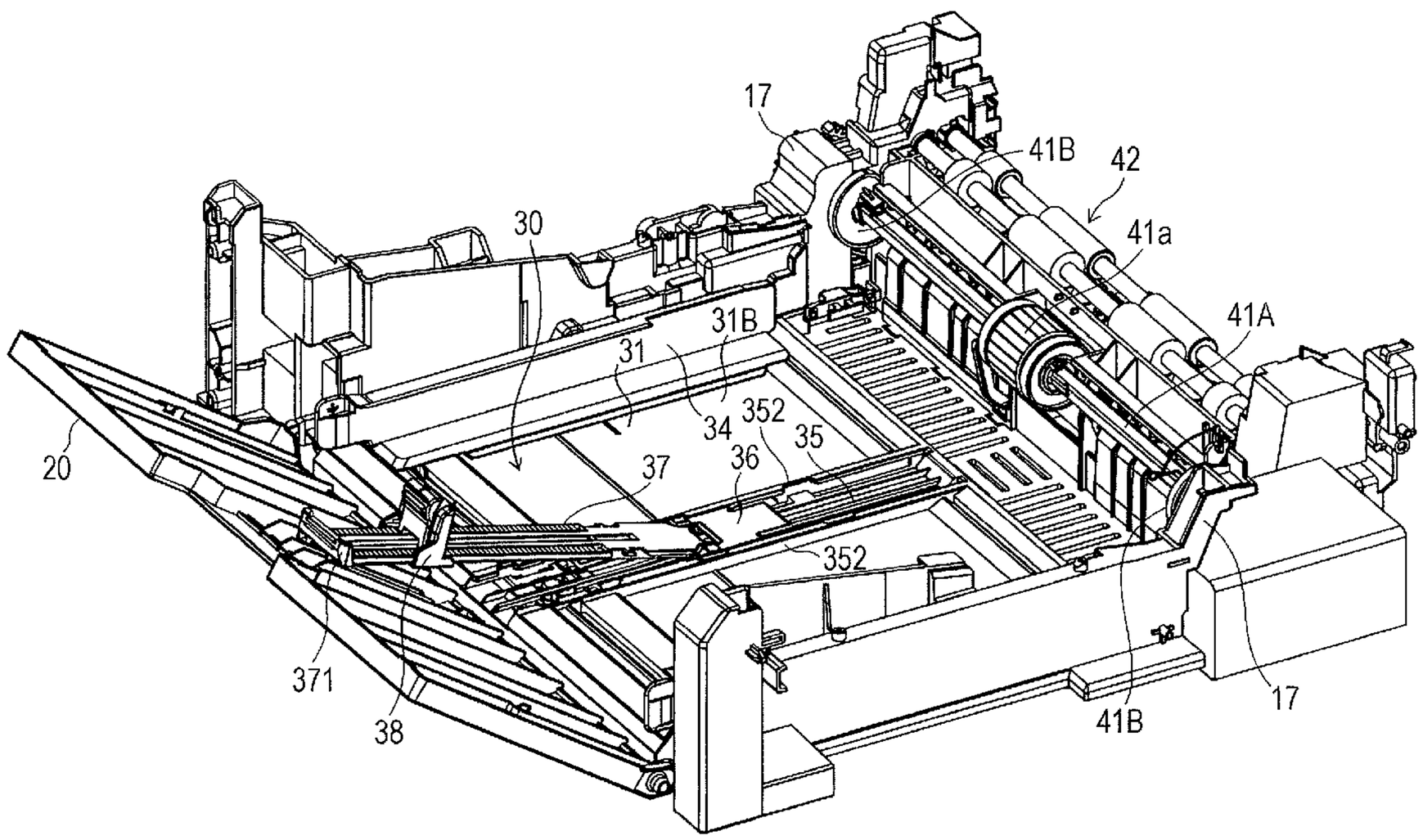
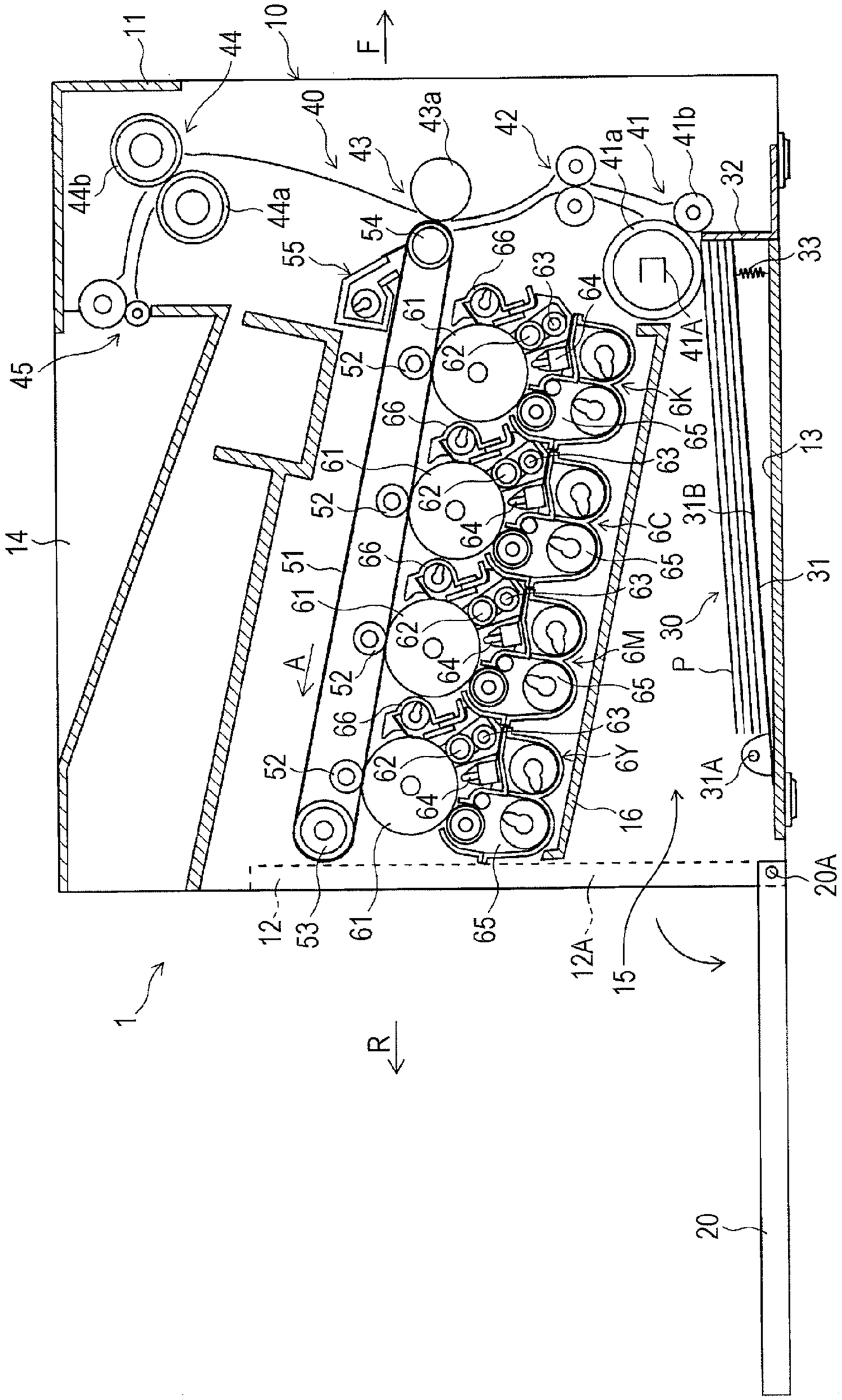


FIG. 1


11
44
10
F
40
43
43a
42
41a
41
41b
32
44b
44a
54
55
66
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33
61
62
52
41A
6K
65
13
31B
6C
51
31
6M
30
P
A
6Y
16
31A
12
53
12A
15
20A
1
R
20

FIG. 2

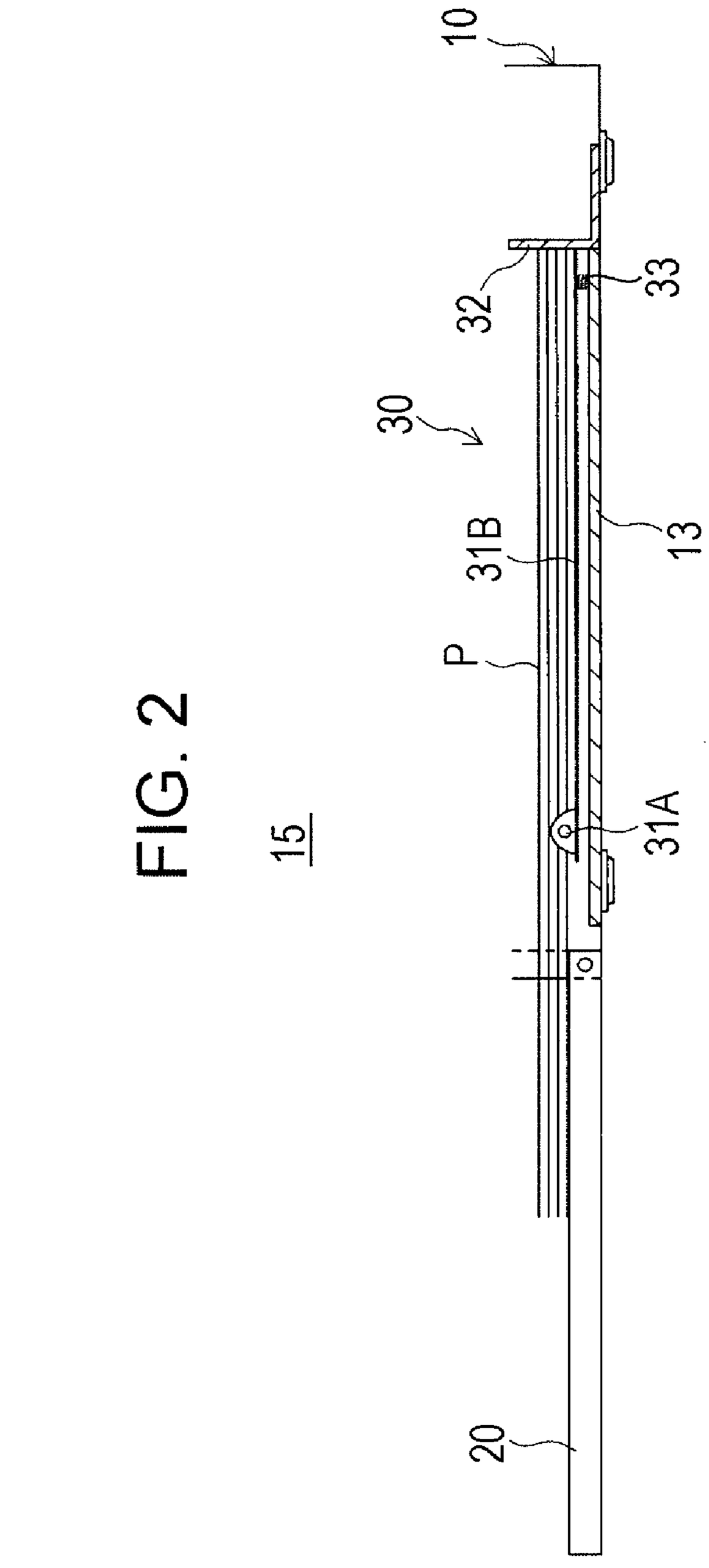
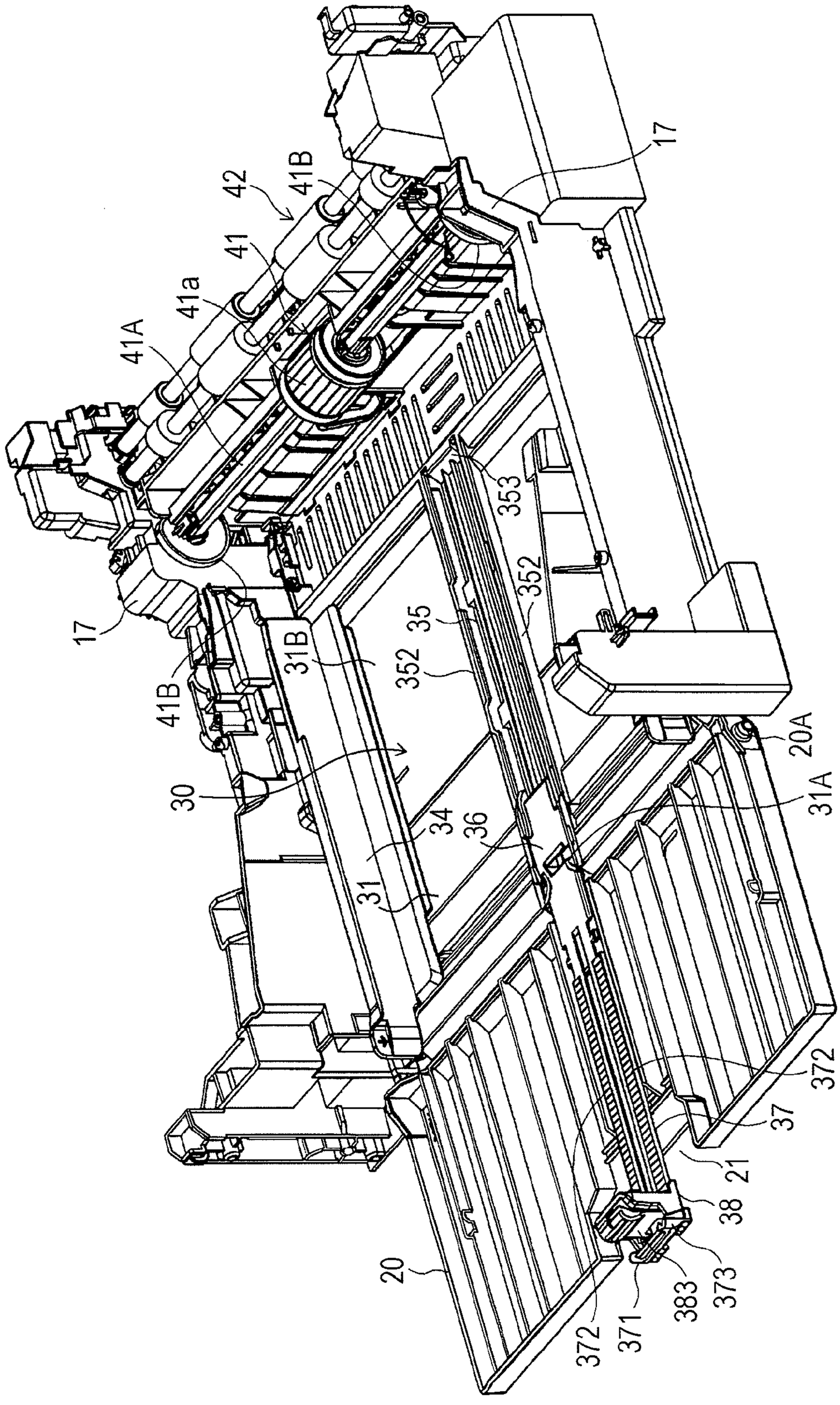


FIG. 3


17
42
41B
41
41a
41A
17
41B
31B
352
35
352
353
352
20A
30
31A
34
36
31
372
37
21
38
383
373
371
372
20

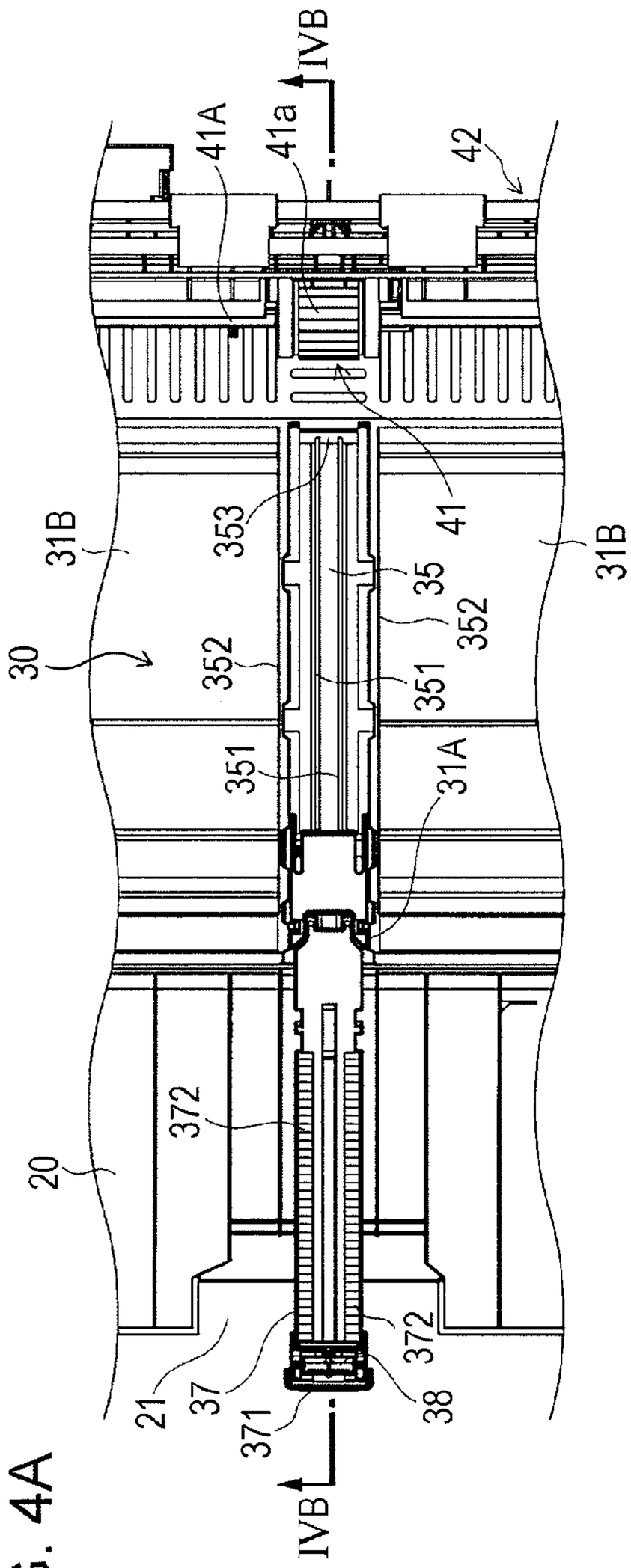
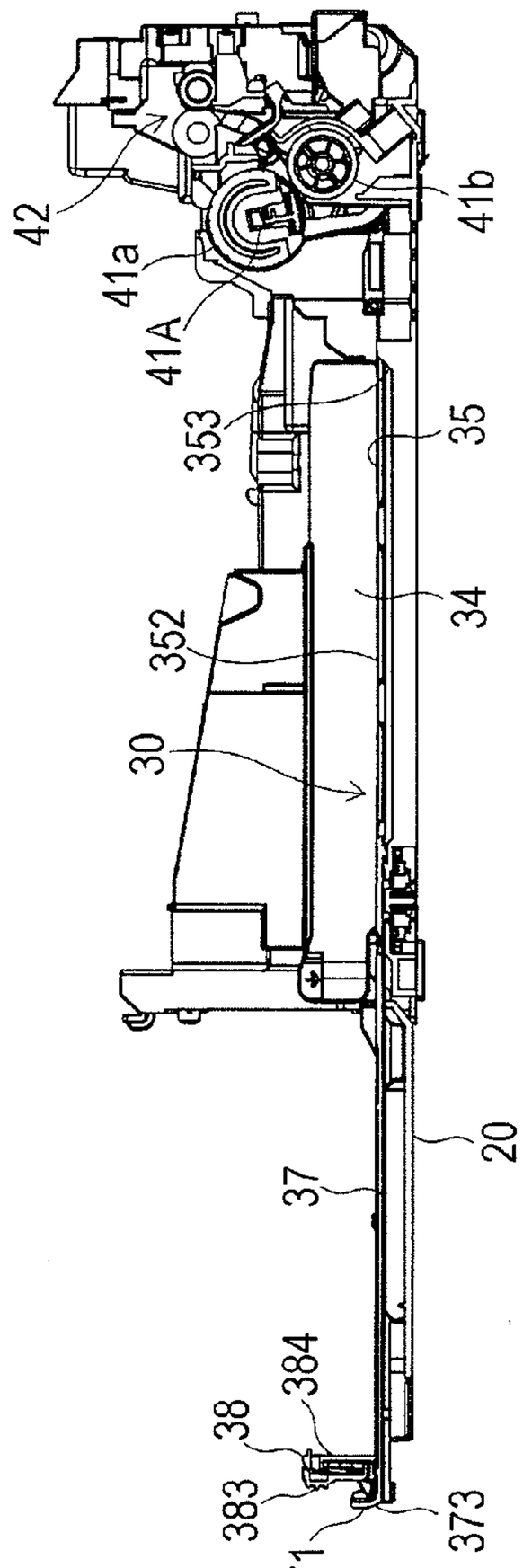

IVB
41A
41a
42
31B
353
41
35
352
351
31A
372
20
21
37
371
38
IVB

FIG. 4A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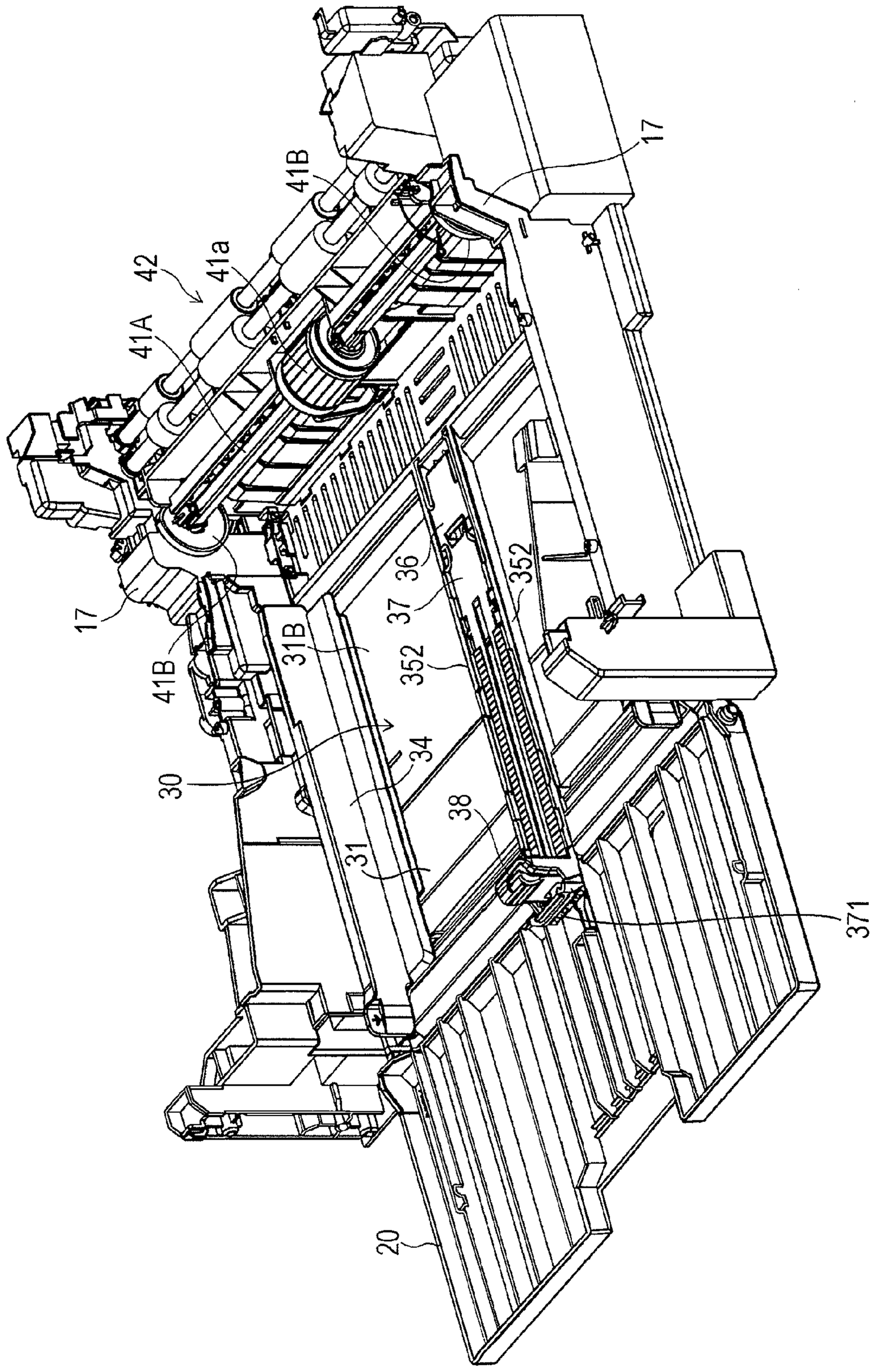
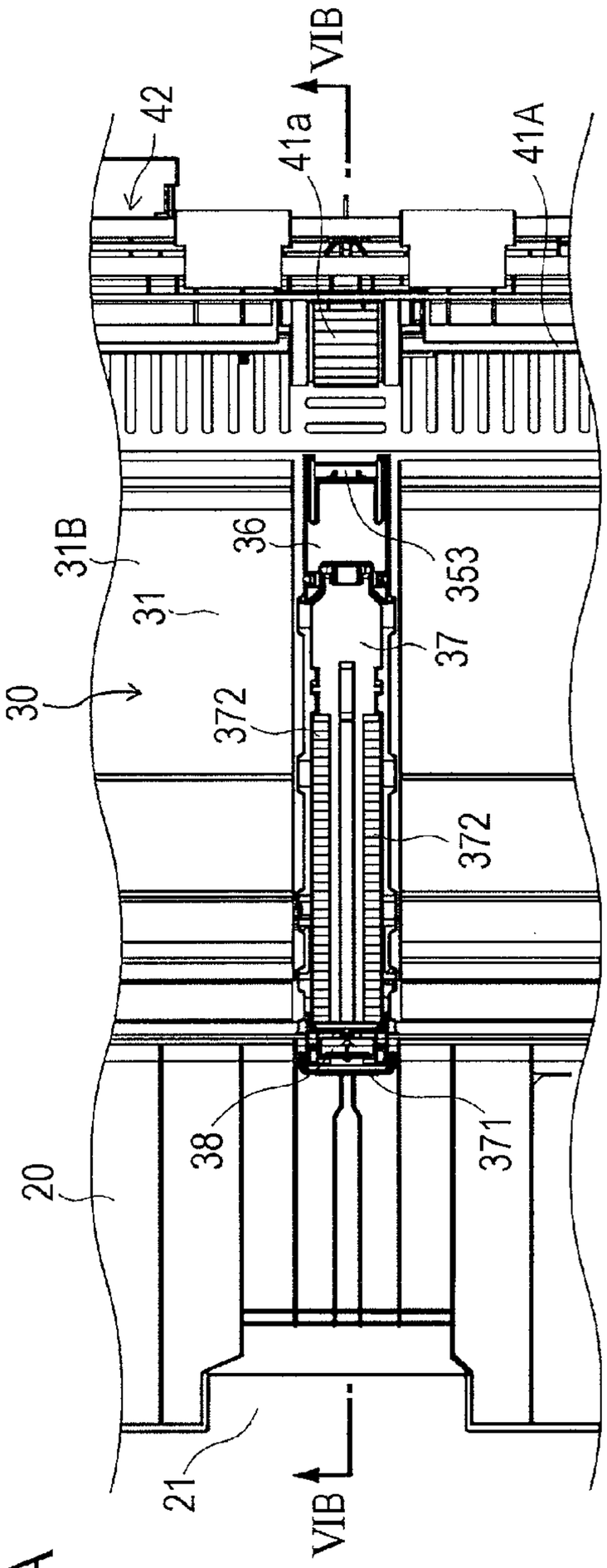
41b
41a
41A
353
35
34
352
30
37
20
384
38
383
371
373

FIG. 4B

FIG. 5

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41A
31B
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31
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30
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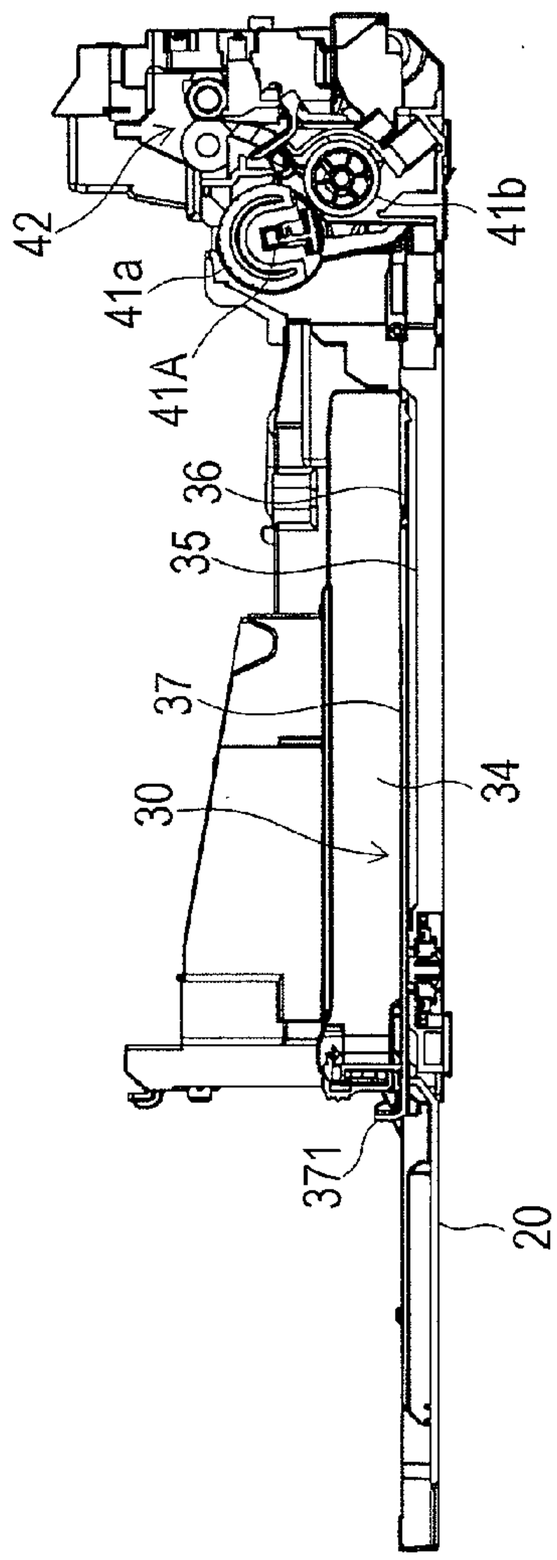
372
38
371
20
21
VIB

FIG. 6A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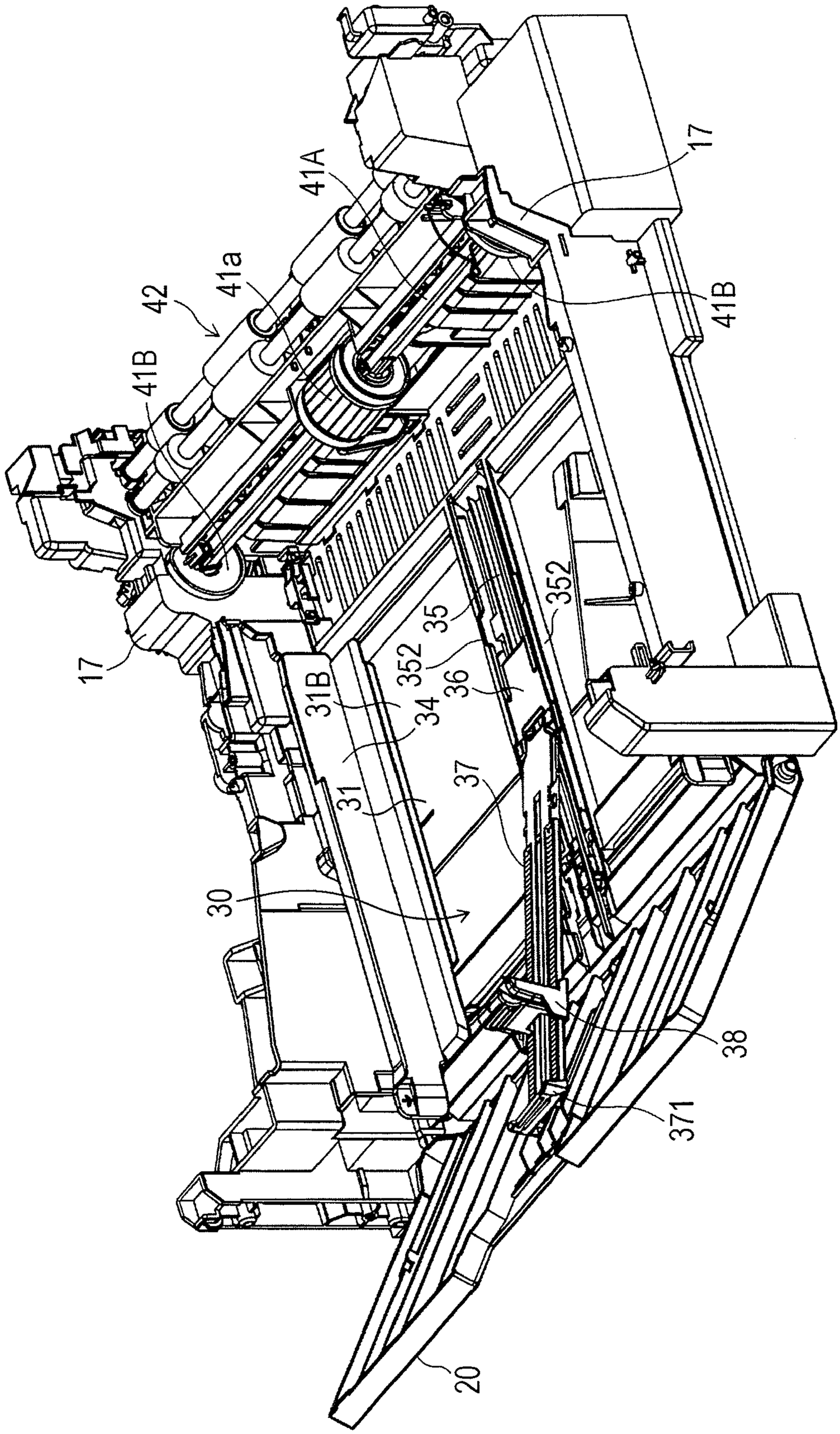
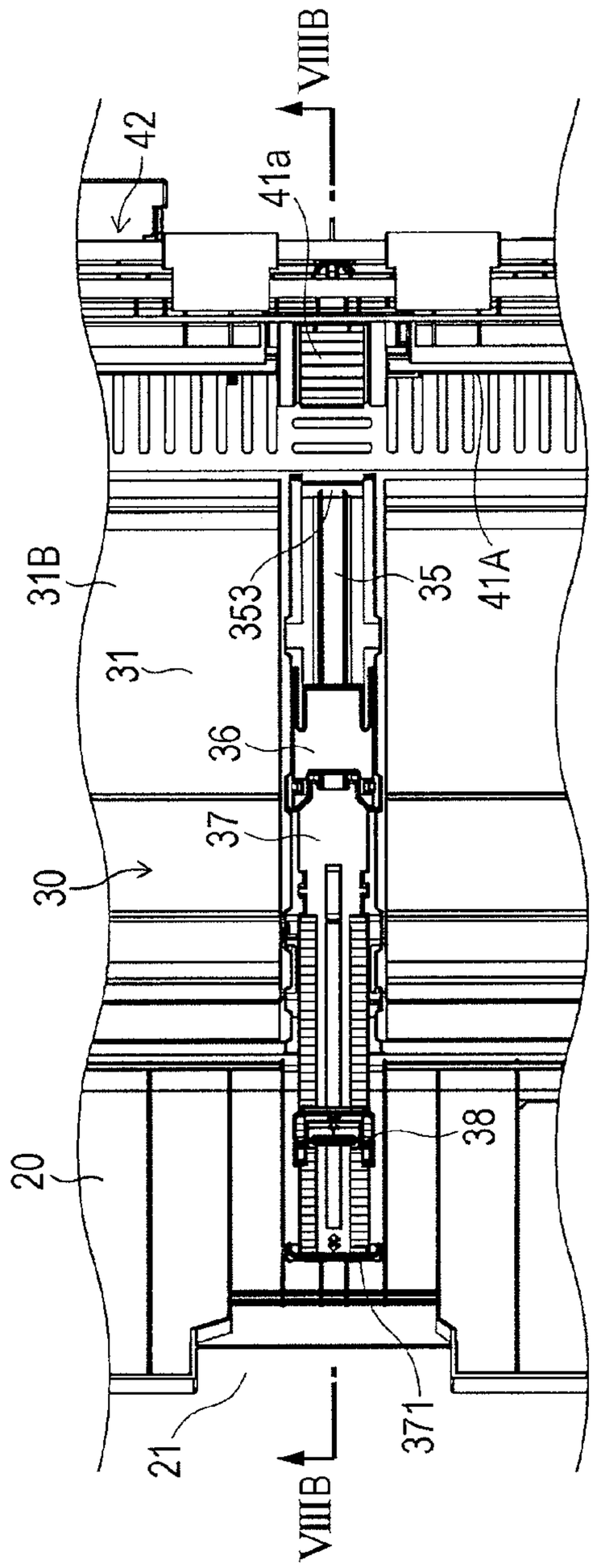
41b
41a
41A
36
35
37
30
34
371
20

FIG. 6B

FIG. 7




VIIIB
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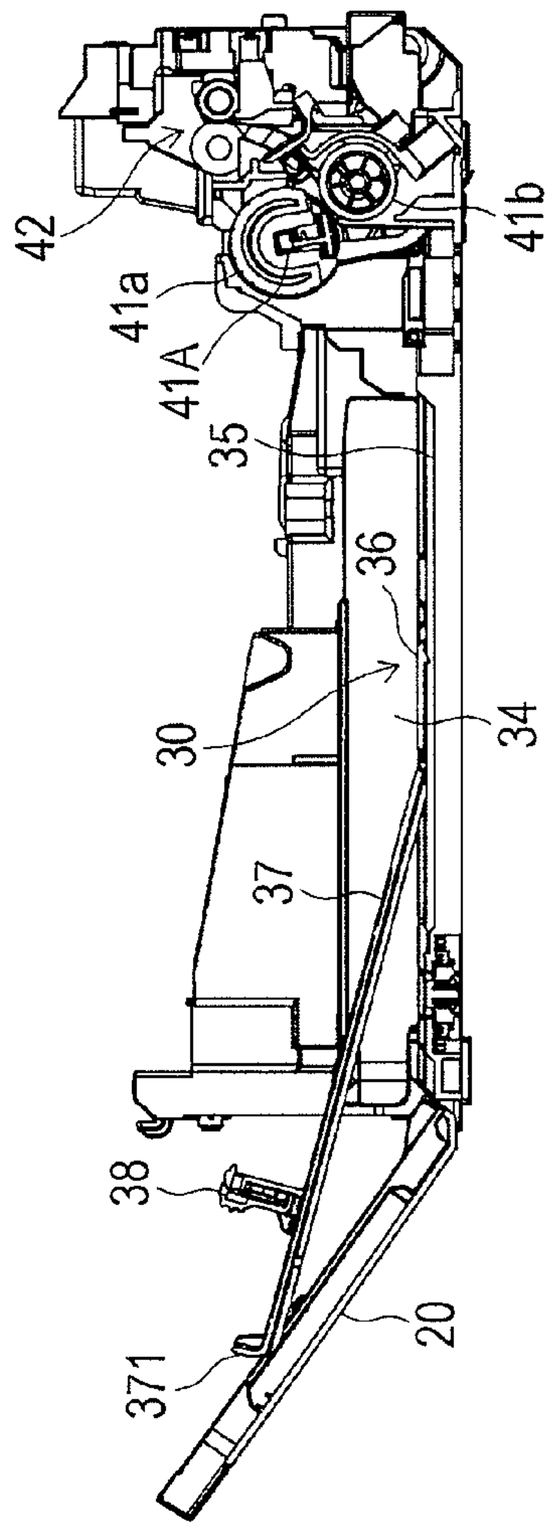
41a
31B
353
35
41A
31
36
37
30
20
38
371
21
VIIIB

FIG. 8A


42
41b
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41A
35
36
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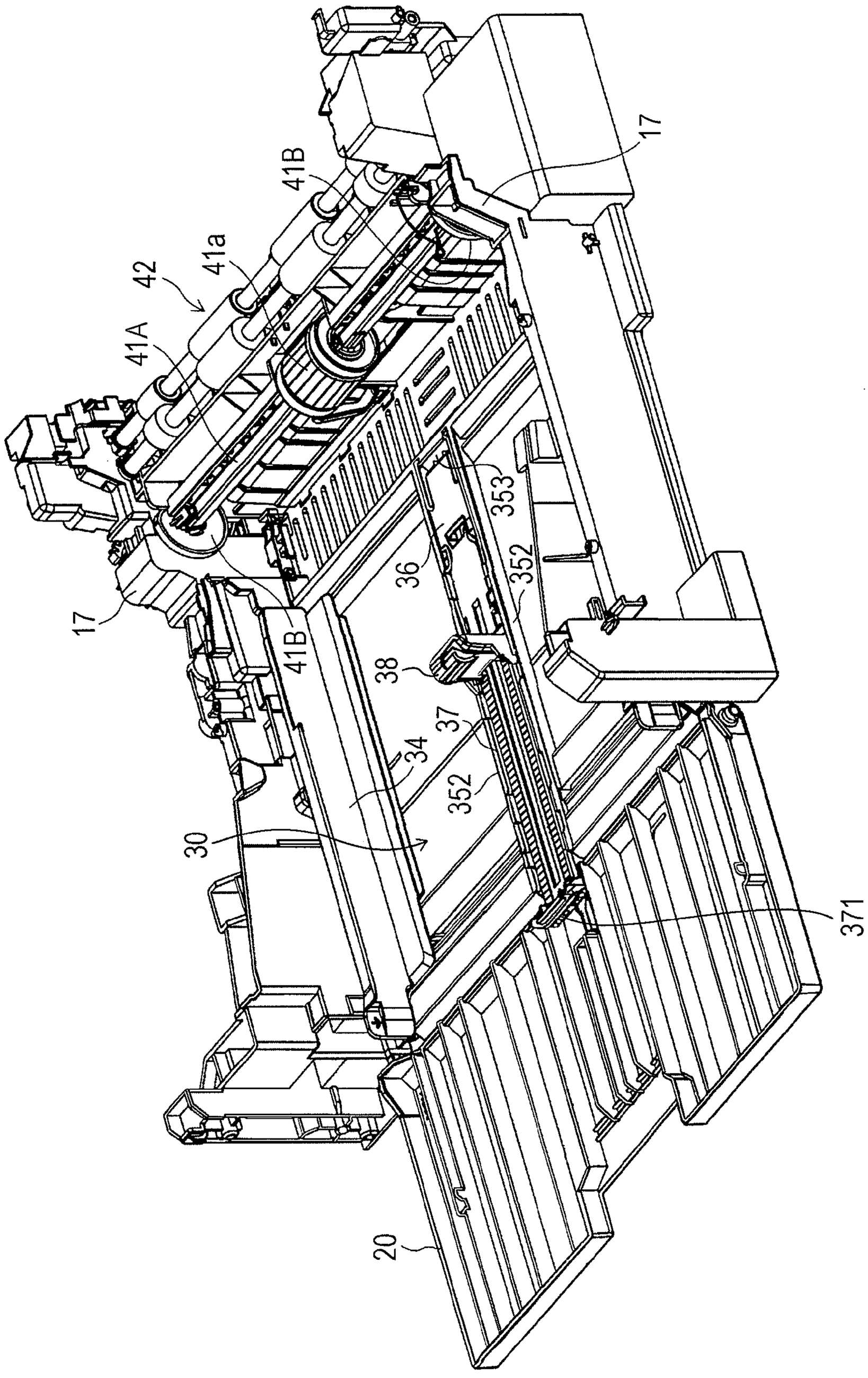
34
37
38
371
20

FIG. 8B

FIG. 9



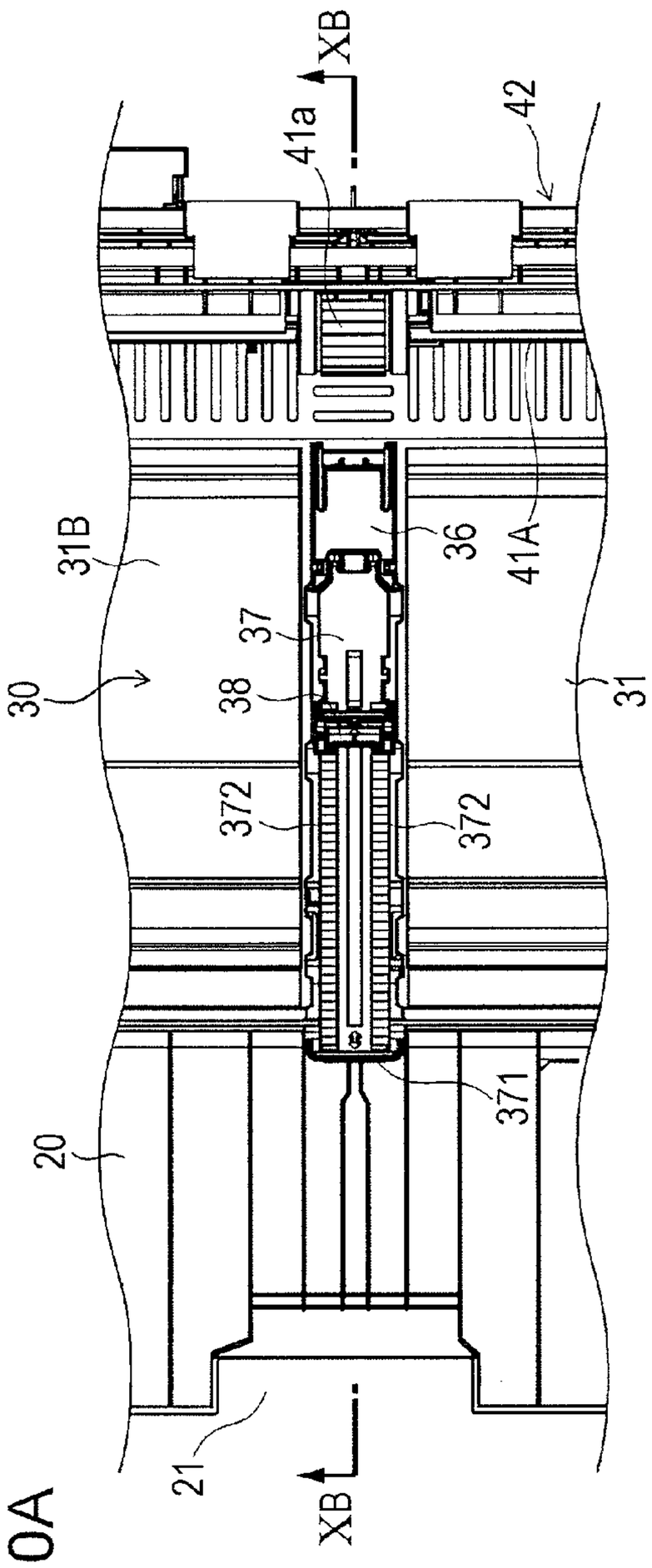


FIG. 10A

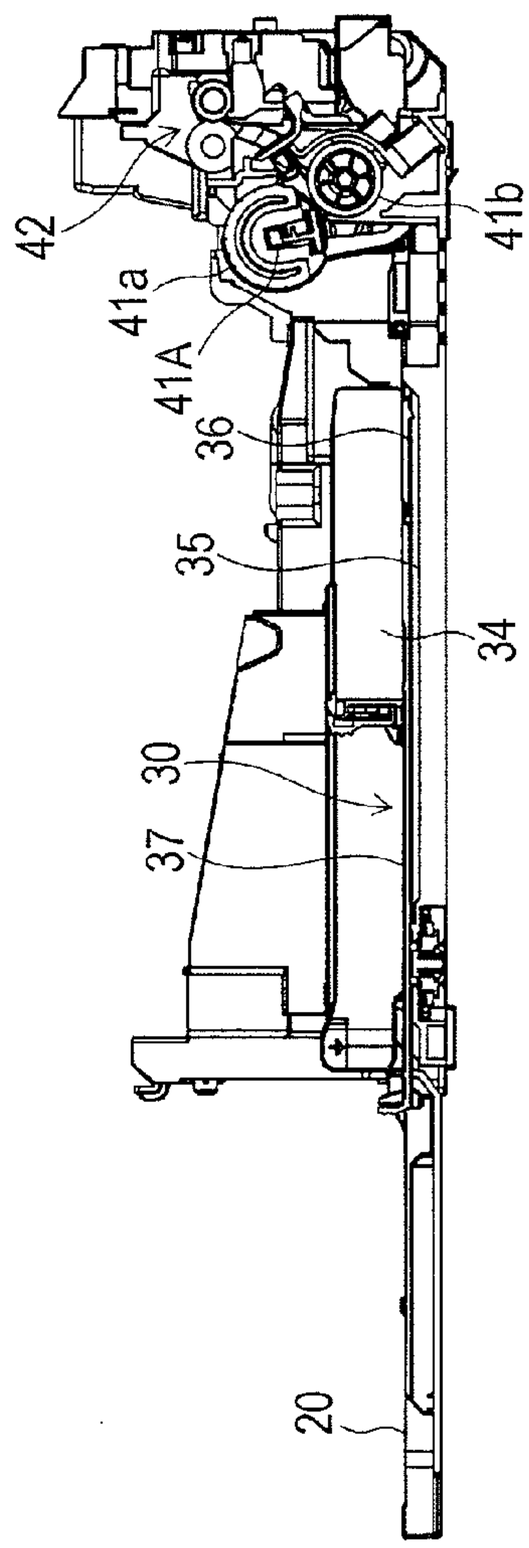


FIG. 10B

FIG. 11

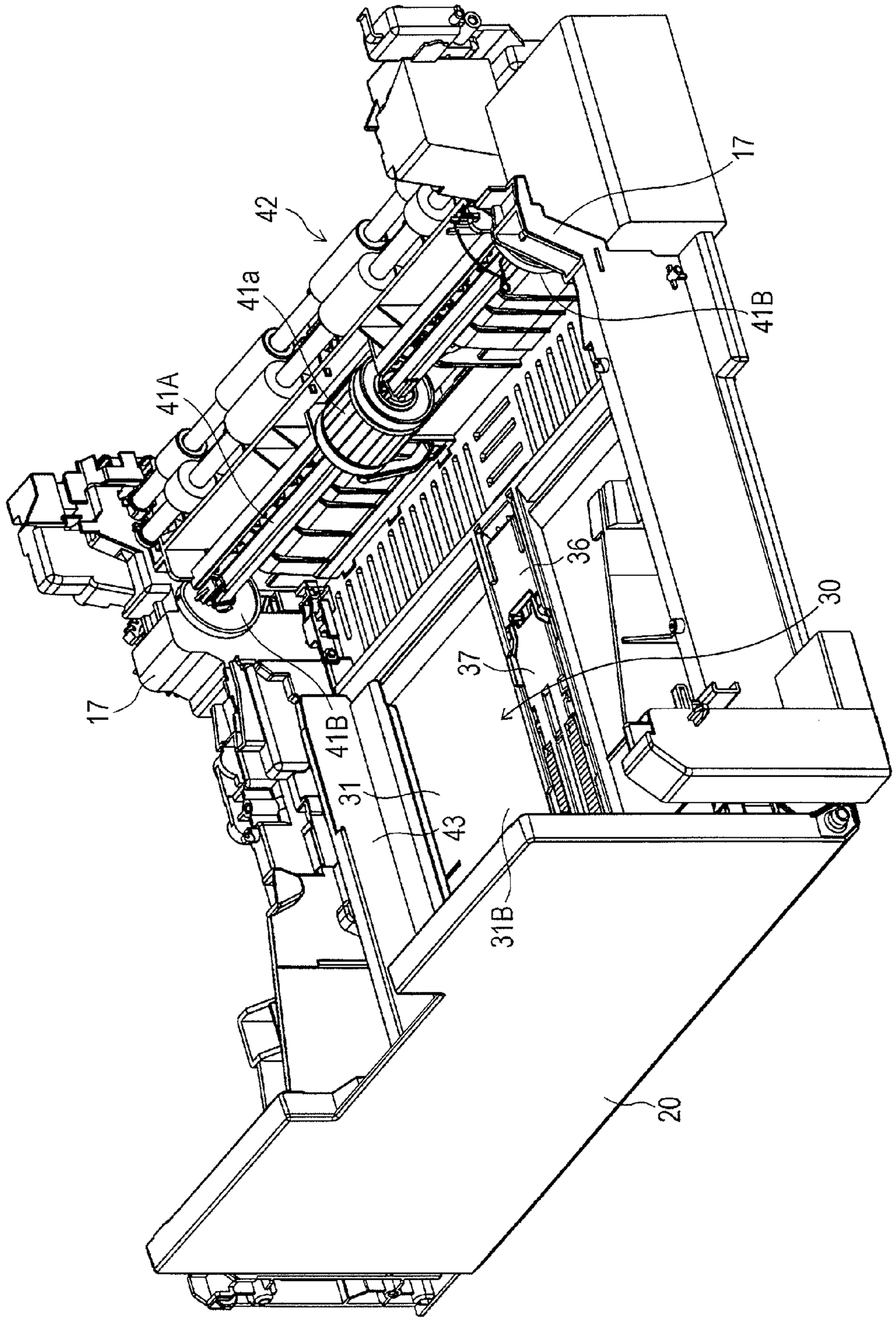


FIG. 12A

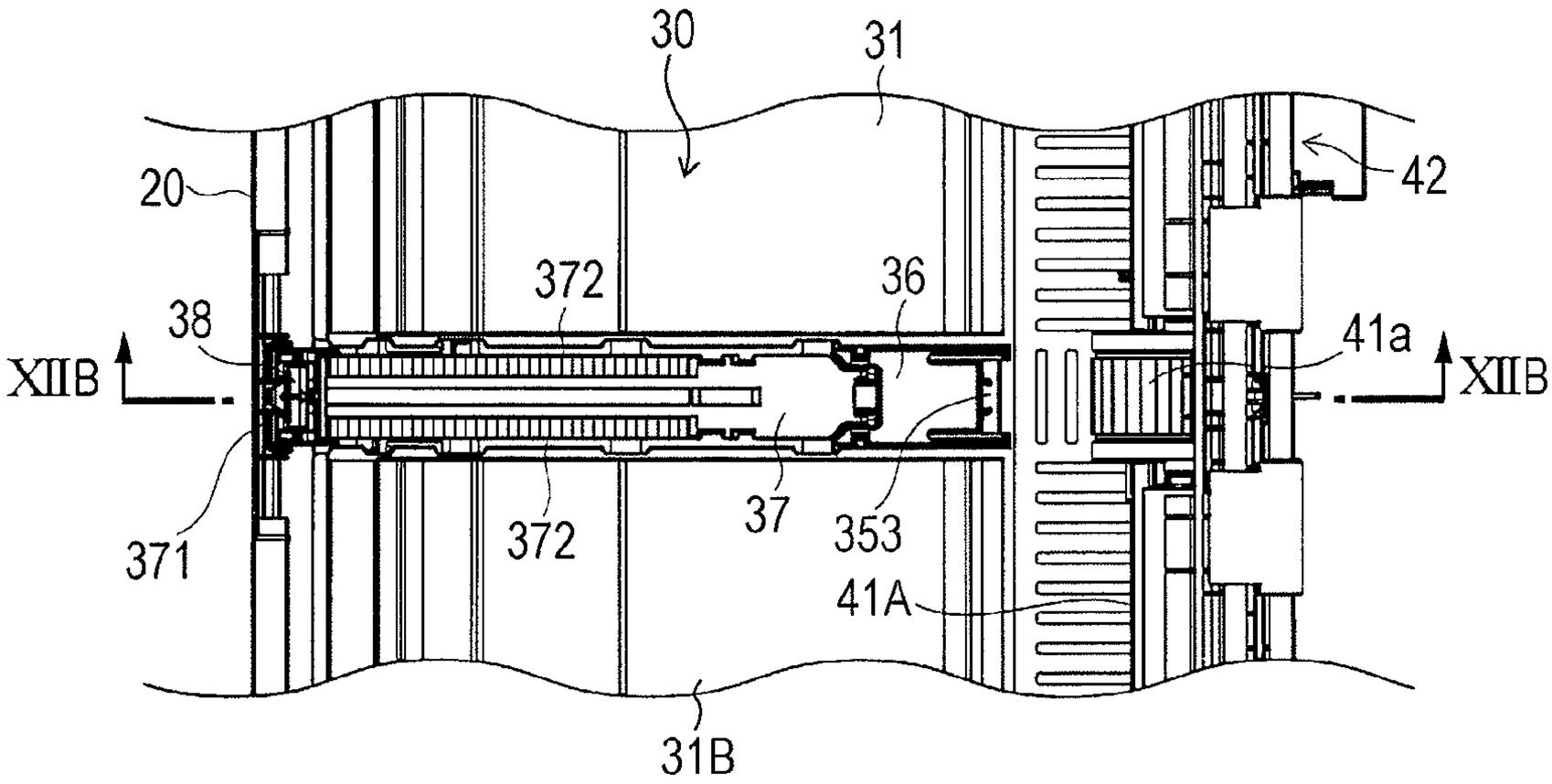


FIG. 12B

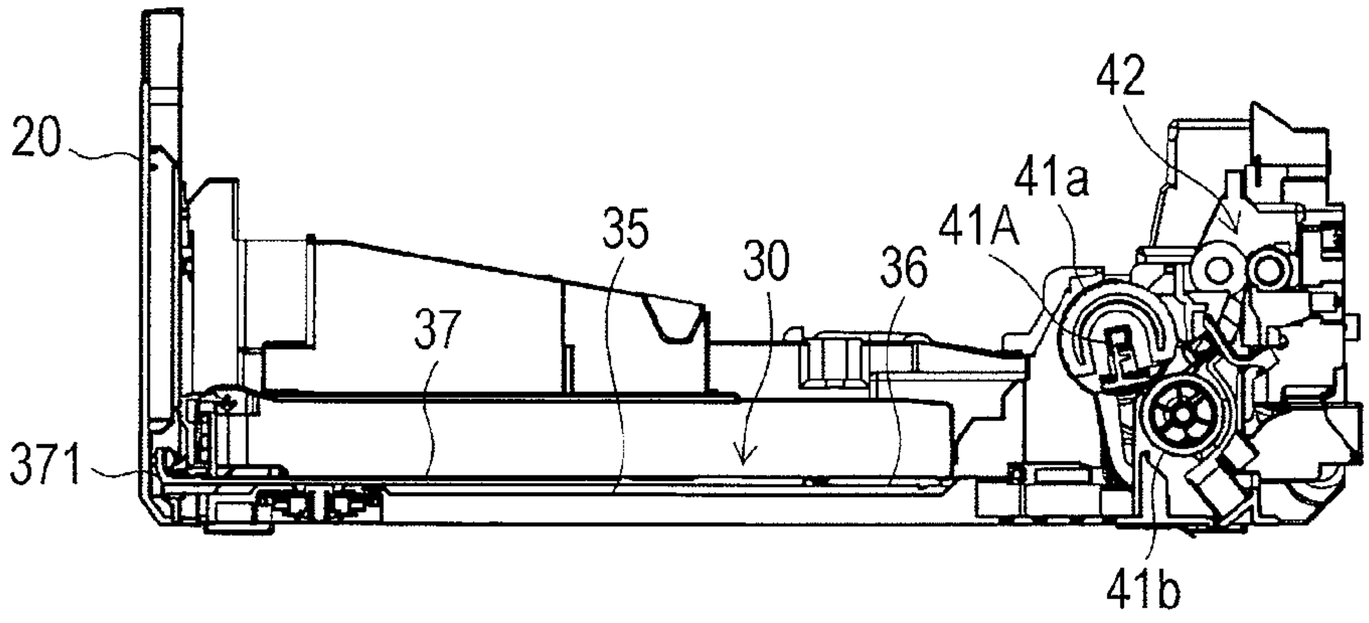


FIG. 13

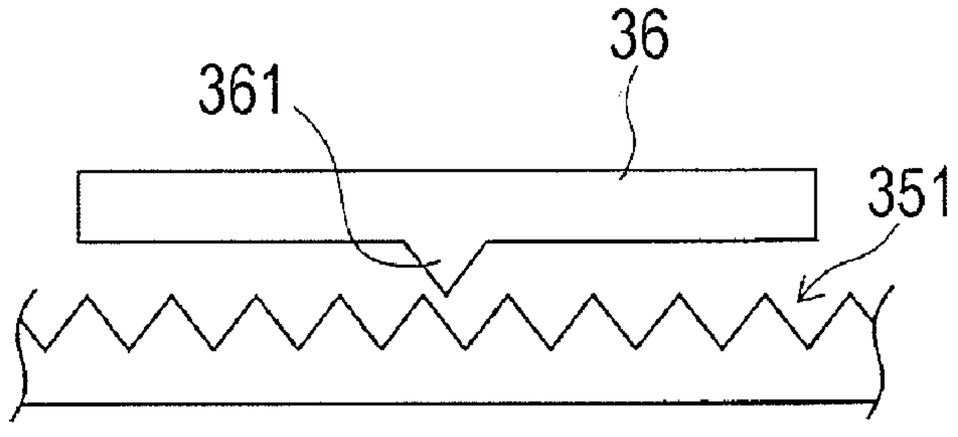


FIG. 14

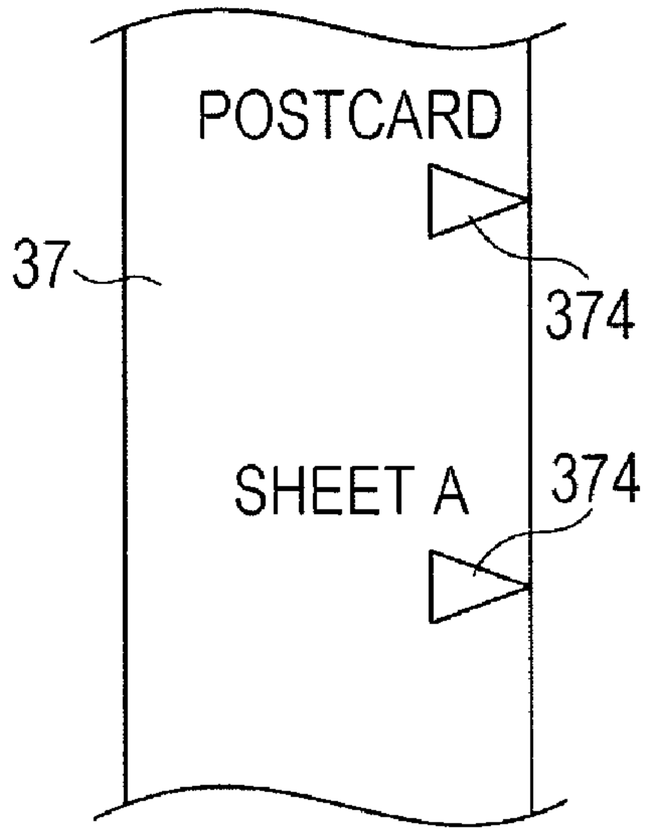


FIG. 15A

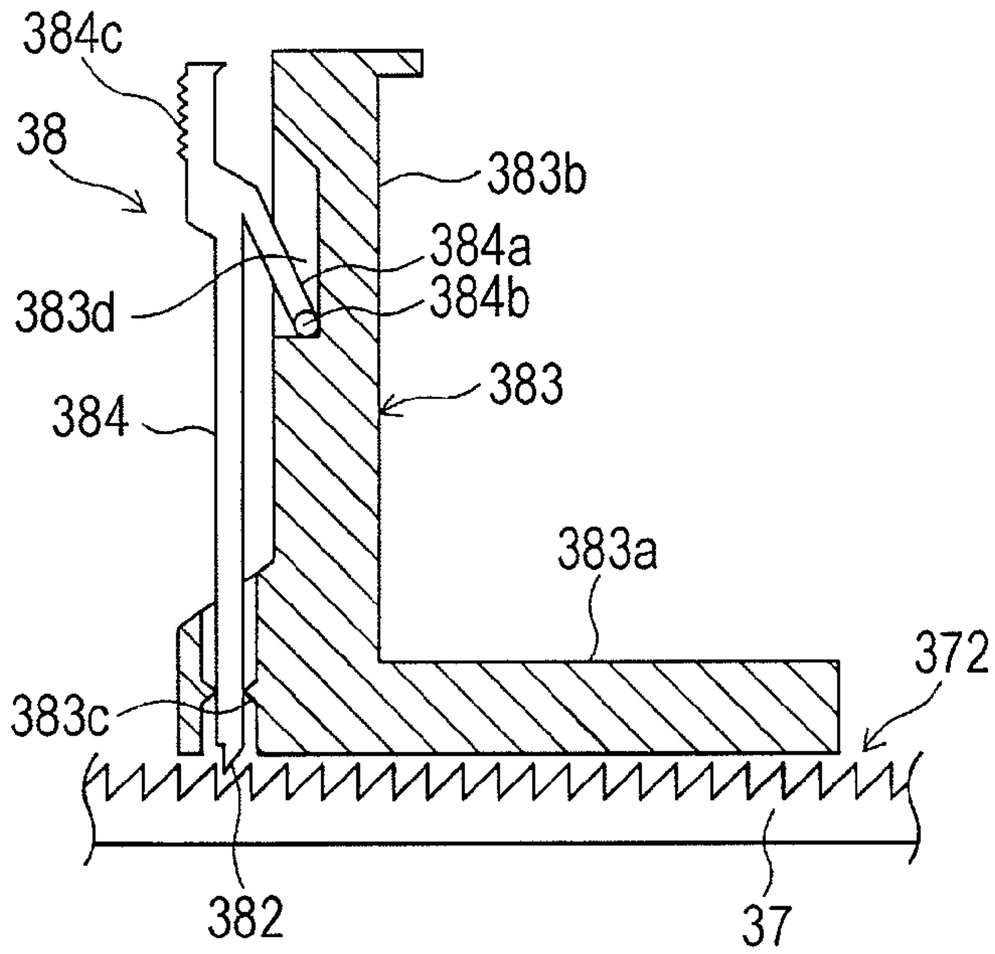
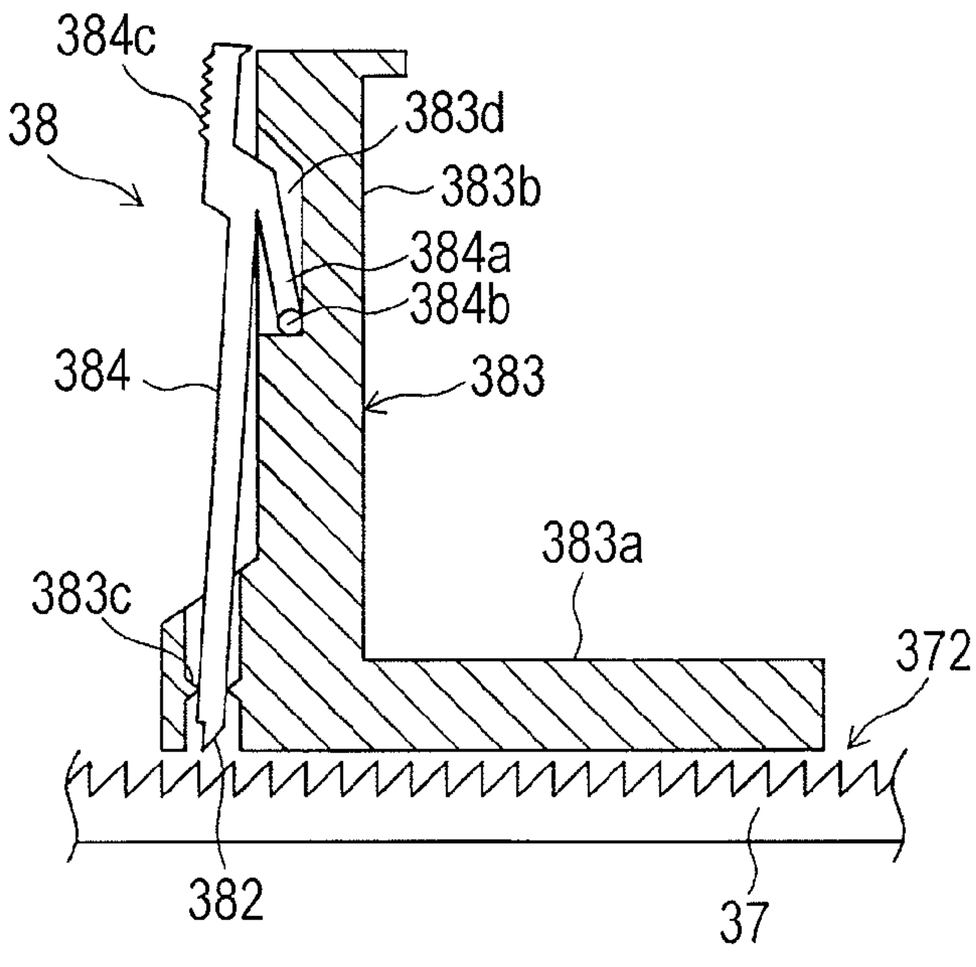


FIG. 15B



FEEDING DEVICE AND IMAGE FORMING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based on and claims priority under 35 USC 119 from Japanese Patent Application No. 2010-087473 filed Apr. 6, 2010.

BACKGROUND

Technical Field

The present invention relates to a feeding device and an image forming apparatus.

SUMMARY

According to an aspect of the invention, there is provided a feeding device including a body having a sheet placement surface on which a sheet that is to be fed is placed; a cover rotatably provided at the body, capable of supporting a back edge portion in a feeding direction of the sheet when the cover is open, and being provided with a rotary shaft, the sheet being placed on the sheet placement surface; a moving member provided at the sheet placement surface so as to be movable in a direction that is parallel to the feeding direction; a linking member extending in a direction of movement of the moving member from the moving member, one end portion of the linking member being rotatably linked to the moving member using a rotary shaft that is parallel to the rotary shaft of the cover; and a sheet back-edge regulating member provided at the linking member so as to be movable in the direction of movement of the moving member, and regulating a back edge in the feeding direction of the sheet placed on the sheet placement surface.

BRIEF DESCRIPTION OF THE DRAWINGS

An exemplary embodiment of the present invention will be described in detail based on the following figures, wherein:

FIG. **1** is a side view of an internal structure of a printer according to an exemplary embodiment of the present invention;

FIG. **2** is a side view of a feed tray and a cover of the printer, and shows a state in which back edge portions of large sheets held on the feed tray are disposed on the open cover;

FIG. **3** is a perspective view of a bottom portion of the printer, and shows a state in which the cover is open and an arm and a slide plate are disposed at backmost positions;

FIG. **4**A is a plan view of a portion of FIG. **3**;

FIG. **4**B is a sectional view taken along an arrow IVB-IVB of FIG. **4**A;

FIG. **5** is a perspective view of the bottom portion of the printer, and shows a state in which the cover is open, and the arm and the slide plate are disposed at frontmost positions, and an end guide is disposed at a backmost position;

FIG. **6**A is a plan view of a portion of FIG. **5**;

FIG. **6**B is a sectional view taken along an arrow VIB-VIB of FIG. **6**A;

FIG. **7** is a perspective view of the bottom portion of the printer, and shows a state in which the arm is rotated when closing the cover;

FIG. **8**A is a plan view of a portion of FIG. **7**;

FIG. **8**B is a sectional view taken along an arrow VIIIB-VIIIB of FIG. **8**A;

FIG. **9** is a perspective view of the bottom portion of the printer, and shows a state in which the cover is open, and the end guide on the arm, disposed at the frontmost position, is positioned at an intermediate position of the arm;

FIG. **10**A is a plan view of a portion of FIG. **9**;

FIG. **10**B is a sectional view taken along an arrow XB-XB of FIG. **10**A;

FIG. **11** is a perspective view of the bottom portion of the printer, and shows a state in which the cover is closed;

FIG. **12**A is a plan view of a portion of FIG. **11**;

FIG. **12**B is a sectional view taken along an arrow XIIB-XIIB of FIG. **12**A;

FIG. **13** is a side view of the slide plate and a grooved portion;

FIG. **14** is a partial plan view of the arm having marks indicating sheet sizes; and

FIGS. **15**A and **15**B are each a side view of the end guide, with FIG. **15**A showing a state in which a second engaging pawl engages a second rack, so that the end guide is incapable of retreating, and FIG. **15**B showing a state in which the second engaging pawl is disengaged from the second rack, so that the end guide is capable of retreating.

DETAILED DESCRIPTION

An exemplary embodiment of the present invention will hereunder be described with reference to the drawings.

(1) Basic Structure and Operation of Printer

First, a basic structure and operation of a printer (image forming apparatus) according to an exemplary embodiment will be described.

FIG. **1** is a schematic view of an internal structure of a printer **1** according to an exemplary embodiment of the present invention. In FIG. **1**, reference numeral **10** denotes a body including a housing **11**. A back side of the body **10** (in the direction of arrow R in FIG. **1**) is open. This opening **12** is covered and uncovered using a cover **20**. In the description below, a front-back direction and an up-down direction refer to directions in the body **10** where the direction R is a direction towards the back and a direction F is a direction towards the front. A lower end of the cover **20** is hinged to the body **10** with a hinge shaft (a rotary shaft of the cover) extending in a left-right direction (a direction towards or away from a viewer of FIG. **1**). The cover **20** is opened and closed by tilting the cover **20** in the front-back direction.

A bottom portion of the body **10** is provided with a feed tray **30**. The feed tray **30** includes a sheet loading plate **31** and a standing plate section **32**. A back edge portion of the sheet loading plate **31** is hinged to a bottom plate section **13** of the body **10** with a rotary shaft **31**A. The standing plate section **32** is disposed at the front side of the sheet loading plate **31**, and is secured to the bottom plate section **13**. The sheet loading plate **31** is biased so as to rotate upward around the rotary shaft **31**A as a fulcrum by a coil spring **33** secured to the bottom plate section **13**. The upper surface of the sheet loading plate **31** is a sheet placement surface **31**B on which sheets is capable of being placed. A large number of sheets P are loaded on the sheet placement surface **31**B. Regulating plates **34** that slide in synchronism in the left-right direction and that contact respective edges of the sheet P to position a sheet widthwise position to the center of the sheet placement surface **31**B are provided at respective sides of the sheet placement surface **31**B.

The sheets P that are loaded upon the sheet placement surface **31**B and whose widthwise positions are determined by the regulating plates **34** are drawn out upward one sheet at a time from an upper sheet by a sheet draw-out section **41**,

move upward along a sheet transport path **40** formed at the front side of the interior of the body **10**, and are discharged to a paper output tray **14** formed at the upper side of the body **10**.

The printer **1** is a tandem full-color printer. The interior of the body **10** includes, for example, a transfer belt **51**, image forming units **6**Y, **6**M, **6**C, and **6**K of four colors, a second transfer section **43**, and a fixing section **44**. The transfer belt **51** is stretched so as to be rotatable and upwardly inclined towards the back (that is, upwardly inclined towards the left in FIG. **1**). The transfer belt **51** rotates in the direction of arrow A. The image forming units **6**Y, **6**M, **6**C, and **6**K are disposed in parallel with each other below the transfer belt **51**, and in parallel with an inclination direction of the transfer belt **51**. A partition plate **16** is disposed below the image forming units **6**Y, **6**M, **6**C, and **6**K so as to oppose the image forming units **6**Y, **6**M, **6**C, and **6**K, with a space **15** being formed between the sheet loading plate **31** and the partition plate **16**. The partition plate **16** is provided parallel with the inclination direction of the transfer belt **51** below the image forming units **6**Y, **6**M, **6**C, and **6**K.

The four image forming units **6**Y, **6**M, **6**C, and **6**K form a yellow (Y) toner image, a magenta (M) toner image, a cyan (C) toner image, and a black (B) toner image, respectively, and have the same basic structure. The four image forming units **6**Y, **6**M, **60**, and **6**K each include a photoconductor drum **61**, a charging roller **62**, a charging roller cleaner **63**, an image exposure device **64**, a developing unit **65**, and a photoconductor drum cleaner **66**. The charging rollers **62**, the charging roller cleaners **63**, the image exposure devices **64**, the developing units **65**, and the photoconductor drum cleaners **66** are disposed around their respective photoconductor drums **61**.

When color image information is input to the printer **1** from, for example, a personal computer, four light beams corresponding to the respective colors exit from the image exposure devices **64**. The light beams scan the surfaces of the photoconductor drums **61** that are charged by the charging rollers **62** and that rotate. This causes electrostatic latent images to be formed on the surfaces of the respective photoconductor drums **61**.

The electrostatic latent images formed on the respective photoconductor drums **61** are developed with developers including toners of the respective colors by the respective developing units **65**. The developed toner images (color images) are subjected to first transfer operations by first transfer rollers **52** so as to be transferred onto a surface (outer peripheral surface) of the rotating transfer belt **51**. The first transfer operations of the developed images from the photoconductor drums **61** to the transfer belt **51** are sequentially performed at predetermined timings at the respective image forming units **6**Y, **6**M, **6**C, and **6**K. When the transfer belt **51** passes the black image forming unit **6**K disposed at the downstreammost side, a full color toner image is formed on the surface of the transfer belt **51**.

Although residual material, such as toner or a discharge product, may be adhered to the surface of each photoconductor drum **61** after the first transfer operation, any residual material is removed by the corresponding photoconductor drum cleaner **66**. The surface of each photoconductor drum **61** is re-charged by its corresponding charging roller **62**. Any residual material that is adhered to any charging roller **62** because the residual material is not completely removed by the corresponding photoconductor drum cleaner **66** is removed by its corresponding charging roller cleaner **63** that contacts the charging roller **62** and rotates.

The transfer belt **51** is wound around a driving roller **53** and a backup roller **54**, and rotates in the direction of arrow A by rotation of the driving roller **53**. The first transfer rollers **52** are disposed at the inner side of the transfer belt **51**. The first transfer rollers **52** and the photoconductor drums **61** of the respective image forming units **6**Y, **6**M, **6**C, and **6**K form nips that nip the transfer belt **51**.

At the second transfer section **43**, the full-color toner image formed on the transfer belt **51** is transferred onto a sheet P that is drawn out from the feed tray **30** by the sheet draw-out section **41** and that moves upward along the sheet transport path **40** at a proper timing. The sheet draw-out section **41** includes a feed roller **41***a* and a sheet separating roller **41***b*. The sheets P are separated one at a time by the sheet draw-out section **41**, are drawn out towards the front, are temporarily transported to a pair of registration rollers **42** (disposed above the sheet draw-out section **41**), and are stopped. Then, the pair of registration rollers **42** that are rotationally driven at a predetermined timing send the sheets P to the second transfer section **43**.

The second transfer section **43** includes the backup roller **54** where the transfer belt **51** is stretched, and a second transfer roller **43***a* that forms a nip with the backup roller **54**. When the sheet P passes between the rollers **54** and **43***a*, the full-color toner image on the transfer belt **51** is transferred to the sheet P. Residual material, such as toner, may adhere to the surface of the transfer belt **51** after the second transfer. However, the residual material is removed by a transfer belt cleaner **55** disposed above a front end portion of the transfer belt **51**.

The fixing section **44** is where the full-color toner image is fixed to the sheet P that has the full-color toner image transferred thereto and that passes the fixing section **44**. The fixing section **44** includes a heating roller **44***a* and a pressure roller **44***b* that forms a nip with the heating roller **44***a*. When the sheet P passes between the rollers **44***a* and **44***b*, the full-color toner image is fixed to the sheet P by pressure bonding and heating. The sheet P that has passed the fixing section **44** is discharged to the paper output tray **14** by a pair of discharge rollers **45**. The sheet transport path **40** is a path extending from the sheet draw-out section **41** to the pair of discharge rollers **45** through the pair of registration rollers **42**, the second transfer section **43**, and the fixing section **44**.

Since the partition plate **16** is parallel with the transfer belt **51** and is inclined upward and backward, the space **15** becomes wider in the up-down direction towards the back. In addition, a portion of the opening **12** that communicates with the space **15** is a sheet supply opening **12**A used to supply the sheet onto the sheet loading plate **31** of the feed tray **30**. The sheet supply opening **12**A and the feed tray **30** are covered and uncovered using the cover **20**.

When the sheet P is transported to form an image, as shown in FIG. **1**, the sheet loading plate **31** is raised upward by the coil spring **33**, and the upper side of an edge of the sheet P press-contacts the lower surface of the feed roller **41***a* of the sheet draw-out section **41**, so that the sheet P is capable of being drawn out by the sheet draw-out section **41**. In contrast, at times other than when an image is formed, a back end portion of the sheet loading plate **31** is pushed downward against the coil spring **33** by eccentric cams **41**B (see FIG. **3**) that rotate together with the feed roller **41***a*. Then, as shown in FIG. **2**, the back end portion of the sheet loading plate **31** is positioned at a sheet supply position where it becomes parallel with the bottom plate section **13**.

The sheet P is supplied onto the sheet loading plate **31** from the sheet supply opening **12**A while the sheet loading plate **31** is positioned at the sheet supply position. The sheet P is inserted until its edge abuts upon the standing plate section **32**, and is loaded onto and held by the sheet loading plate **31**. In the printer **1**, as shown in FIG. **2**, while the cover **20** is

completely opened and set horizontally, and the back edge of the sheet P is loaded on and supported by an upwardly facing inner surface of the cover **20**, a sheet P having a length that is larger than the depth of the feed tray **30** is capable of being supplied onto the sheet loading plate **31** of the feed tray **30**.

(2) Structure of Feed Tray

Next, the feed tray **30** will be described in detail. FIG. **3** shows the feed tray **30** (including the sheet loading plate **31**), the cover **20**, the feed roller **41***a*, and the pair of registration rollers **42**. The feed roller **41***a* is concentrically secured to a rotary shaft **41**A extending in the left-right direction. The rotary shaft **41**A is rotatably supported at a bearing section **17** formed at the body **10**. The eccentric cams **41**B are secured to respective end portions of the rotary shaft **41**A.

Left and right side plates **352** extending in the front-back direction are provided at a central portion in a widthwise direction of the sheet placement surface **31**B of the sheet loading plate **31**. A grooved portion **35** is formed between the side plates **352**. A slide plate (moving member) **36** that is capable of sliding in the front-back direction along the grooved portion **35** is incorporated in the grooved portion **35**. As shown in FIG. **13**, a first rack (first engaging section) **351** having alternately and continuously formed protrusions and recesses and extending in the front-back direction is formed at a bottom portion of the grooved portion **35**, whereas a first engaging pawl **361** that is capable of engaging the protrusions of the first rack **351** is formed at the lower surface of the slide plate **36**.

When the slide plate **36** is moved by a force that is equal to or greater than a predetermined force, the slide plate **36** slides along the grooved portion **35** while a tactile feel is generated as a result of the first engaging pawl **361** moving over the protrusions of the first rack **351**. The slide plate **36** is slidable from a front end portion to a back end portion of the grooved portion **35**. A range of movement of the slide plate **36** is regulated by causing the slide plate **36** to abut upon stoppers **353** provided at a front end and a back end of the grooved portion **35**, respectively.

A front end portion of an arm (linking member) **37** extending in a longitudinal direction of the grooved portion **37** is rotatably linked to a back end portion of the slide plate **36** through a rotary shaft **37**A that is parallel with a hinge shaft **20**A of the cover **20**. An upwardly standing gripping portion **371** is formed at a back end portion of the arm **37**. FIGS. **3** and **4**A and **4**B each show a state in which, while the cover **20** is completely open, the arm **37** is drawn out towards the back and the slide plate **36** is positioned at its backmost position. At this time, the arm **37** is placed on the inner surface of the open cover **20**. The arm **37** is slidable in the front-back direction along with the slide plate **36**. As shown in FIGS. **5** and **6**A and **6**B, when the slide plate **36** is disposed at its frontmost position, the arm **37** is disposed in the grooved portion **35**, so that, as shown in FIGS. **11** and **12**A and **12**B, the cover **20** is capable of being closed. Even if the arm **37** is disposed in the grooved portion **35**, the arm **37** is rotatable upward around the rotary shaft **37**A as a fulcrum.

When the cover **20** is opened and the arm **37** is drawn out towards the back, the arm **37** moves along the inner surface of the cover **20**. As shown in FIGS. **3** and **4**A and **4**B, when the slide plate **36** is positioned at its backmost position, the gripping section **371** at the back end of the arm **37** is positioned slightly towards the back from an upper end portion of the cover **20**. A cutaway portion **21** for opening the cover **20** with one's hand is formed in a central portion of the upper end portion of the cover **20**.

As shown in FIGS. **7** and **8**A and **8**B, if the cover **20** is closed while the slide plate **36** is positioned in the grooved portion **35**, the arm **37** is rotated upward with respect to the rotary shaft **37**A as a fulcrum by the cover **20**, and is rotated upward along with the cover **20**. At this time, a lower portion of the back surface of the gripping section **371** at the back end portion of the arm **37** rotates upward while opposing and contacting and sliding along the inner surface of the cover **20**. The lower portion of the back surface of the gripping section **371** that contacts and slides along the inner surface of the cover **20** is formed as a curved surface **373** that is in accordance with a direction of rotation of the arm **37** itself.

As shown in FIGS. **15**A and **15**B, a second rack (second engaging section) **372** extending in a longitudinal direction of the arm **37** is formed in a predetermined area of the upper surface of the arm **37** extending forwardly from the gripping section **371**. An end guide (sheet back-edge regulating member) **38** that is slidable along the second rack **372** in the front-back direction is mounted to the arm **37**. The end guide **38** includes a guide plate section **383** and a disengaging lever (engaging pawl disengaging unit, disengaging member) **384**. The guide plate section **383** has an L shape in side view, and has a gripping section **383***b* standing upward from the back end of a base portion **383***a* slidably fitted to the arm **37**. The disengaging lever **384** is mounted to the back side of the gripping section **383***b* of the guide plate section **383**.

A lower end portion of the disengaging lever **384** is inserted into a narrow portion **383***c* and is movable in the up-down direction. The narrow portion **383***c* is formed at the front side of a lower end portion of the guide plate section **383**. A second engaging pawl **382** having an inclined surface that is inclined backward as the front surface extends backward is formed at the lower end of the disengaging lever **384**. A supporting portion **384***a* extending forwardly and downwardly is formed at the front surface of an upper end portion of the disengaging lever **384**. The supporting portion **384***a* is inserted in a recess **383***d* that is formed in the back surface of the gripping section **383***b* while a lower end **384***b* is in contact with the recess **383***d*. A push section **384***c* is formed in the back surface of the upper end portion of the disengaging lever **384**.

In the end guide **38**, if the push section **384***c* of the disengaging lever **384** is pushed forward, as shown in FIG. **15**B, the disengaging lever **384** is such that the supporting portion **384***a* rotates clockwise around the lower end **384***b* as a fulcrum, and the lower end portion of the disengaging lever **384** moves upward because the lower end portion of the disengaging lever **384** is regulated by the narrow portion **383***c*. At this time, the second engaging pawl **382** moves out of a recess of the second rack **372**, and is disengaged, thereby making it possible for the end guide **38** to slide in the front-back direction along the arm **37**. The push section **384***c* of the disengaging lever **384** is capable of being pushed forward by gripping the gripping section **383***b* and the push section **384***c*. If a push force of the push section **384***c* is removed, the disengaging lever **384** rotates counterclockwise from a state shown in FIG. **15**B, and moves downward as shown in FIG. **15**A because its lower end portion is regulated by the narrow portion **383***c*. This causes the second engaging pawl **382** to moved into and engage a recess of the second rack **372**.

A force that causes the second engaging pawl **382** to engage the second rack **372** is set so as to be stronger than a force that causes the first engaging pawl **361** of the slide plate **36** to engage the first rack **351** at the bottom portion of the grooved portion **35**. Therefore, if the end guide **38** is pushed forward while the second engaging pawl **382** of the disengaging lever **384** is engaged with the second rack **372** (the state shown in FIG. **15**B), the arm **37** moves forward, so that the slide plate **36** is pushed forward. Consequently, it is possible

to slide the slide plate **36** using the end guide **38**, thereby making the apparatus easy to use.

When the slide plate **36** contacts the stopper **353** as a result of pushing the slide plate **36** forward, and is no longer capable of sliding further forward, the end guide **38** is forwardly slidable without pushing the disengaging lever **384**. This is because the front surface of the second engaging pawl **382** is an inclined surface that is inclined towards the back as it extends downward. That is, when the end guide **38** is pushed forwardly without pushing the disengaging lever **384**, the inclined surface of the second engaging pawl **382** moves on the inclined surface of the second rack **372** and moves over a protrusion thereof, so that the end guide **38** slides forward along the arm **37**. Here, the end guide **38** is forwardly slidable while a tactile feel is generated as a result of the second engaging pawl **382** moving over the protrusions of the second rack **372**. In order to push the end guide **38** forwardly without pushing the disengaging lever **384**, the gripping section **383***b* of the guide plate section **383** is pushed. As shown in FIG. **15**B, when the second engaging pawl **382** engages the second rack **372**, backward movement of the end guide **38** is regulated as along as it is not disengaged by the disengaging lever **384**.

As shown in FIG. **14**, marks (sheet size indicators) **374** indicating various sizes of sheets P supplied to the feed tray **30** are formed on the upper surface of the arm **37** so as to be separated from each other in a longitudinal direction. Any mark **374** is capable of being formed. For example, a mark is formed to indicate a small size such as a postcard size. In a state in which the end guide **38** is aligned with the mark **374** and the arm **37** is slid forwardly until the slide plate **36** abuts upon the front stopper **353**, the interval from the standing plate section **32** to the end guide **38** is set so as to correspond to a sheet size length corresponding to the mark **374** with which the end guide **38** is aligned.

(3) Operation of Feed Tray and Advantages Resulting Therefrom

As described above, the sheets P that are set on the feed tray **30** are subjected to an image forming operation (that is, printing) while transporting the sheets P along the sheet transport path **40**. The sheets P are set on the feed tray **30** while the front edges (in a draw-out direction) of the sheets P abut upon the standing plate section **32** and the end guide **38** abuts upon the back edges (in the draw-out direction) thereof so as to regulate backward shifting of the sheets P at all times. Since the sheets P are not shifted backward due to the end guide **38**, the sheets P are reliably transported into the sheet transport path **40** by the sheet draw-out section **41**. A method of setting sheets P on the feed tray **30** and operational advantages when large sheets whose back edges are placed on the open cover **20** are set, and a method of setting sheets P on the feed tray **30** and operational advantages when small sheets that fit within the back side in the body **10** are set will hereunder be described.

The large sheets are set in the following way. The cover **20** is opened and set horizontally. Then, the gripping section **371** is gripped to slide the arm **37** backwards. Then, as shown in FIGS. **3** and **4**A and **4**B, the slide plate **36** is disposed at its backmost position. Then, the end guide **38** is slid to the back end of the arm **37**. From this state, the large sheets are inserted into the space **15** from the sheet supply opening **12**A, are placed on the sheet placement surface **31**B of the sheet loading plate **31**, are inserted until their edges abut upon the standing plate section **32**, and are loaded on the sheet placement surface **31**B as a whole.

Then, the end guide **38** is slid forwardly, and abuts upon the back edges of the sheets. The end guide **38** is slid forwardly by sliding the end guide **38** forwardly along the arm **37** or by gripping the gripping section **371** and sliding the whole arm **37** forwardly. This causes the large sheets to be set on the feed tray **30** while preventing the large sheets from being shifted forwardly by causing the back edges of the large sheets to abut upon the end guide **38**.

Next, small sheets are set in the following way. The cover **20** is opened and set horizontally. Then, the gripping section **371** is gripped to slide the arm **37** and the end guide **38** backwards. Then, the small sheets are placed at the front side of the end guide **38**. Then, while forwardly sliding the end guide **38** along the arm **37** and causing the end guide **38** to abut upon the back edges of the small sheets, the end guide **38** is positioned to a mark **374** indicating the corresponding sheet size. Next, from this state, the arm **37** is slid backwards until the edges of the sheets abut upon the standing plate section **32**. By this, the small sheets are set on the feed tray **30** while preventing the small sheets from being shifted forwardly by causing the back edges of the small sheets to abut upon the end guide **38**. FIGS. **9** and **10**A and **10**B each show exemplary positions of the arm **37** and the end guide **38** when such sheets are set.

According to the feed tray **30** in the exemplary embodiment, when the small sheets that may move into the back side of the feed tray **30** when they are set are set, the end guide **38** is forwardly slid to the mark **374** indicating the sheet size after temporarily setting the small sheets at the front side of the arm **37** drawn out towards the back. Then, by forwardly sliding the arm **37**, the small sheets is capable of being set. Therefore, even when the space **15** above the feed tray **30** is narrow, the small sheets is capable of being set on the feed tray **30**.

The cover **20** may be closed while the arm **37** is drawn out towards the back and is placed on the cover **20**. However, here, since the arm **37** rotates along with the cover **20** around the rotary shaft **37**A as a fulcrum, damage to the arm **37**, such as bending or breakage of the arm **37**, does not occur, thereby making the apparatus safe to use. In particular, the gripping section **371** at the back end of the arm **37** may rotate while contacting and sliding along the inner surface of the cover **20**. However, since the lower portion of the back surface of the gripping section **371** opposing the inner surface of the cover **20** is formed into the curved surface **373** that is in accordance with the direction of rotation of the arm **37** itself, the gripping section **371** properly slides along with the cover **20**. As a result, the arm **37** rotates smoothly so as not to prevent an opening/closing operation of the cover **20**.

In the body **10**, the arm **37** slides in the front-back direction while the arm **37** is disposed in the grooved portion **35**. Therefore, the arm **37** is infrequently shifted in a lateral direction, thereby making it possible to correctly slide the arm **37** and the end guide **38** in the front-back direction.

The end guide **38** is slid by gripping the gripping section **383***b* and the disengaging lever **384** and forwardly pushing the push section **384***c*. In other words, as the end guide **38** is gripped and slid, the push section **384***c* of the disengaging lever **384** is naturally pushed, so that the second engaging pawl **382** is capable of being disengaged from the second rack **372**. Accordingly, a mechanism that is easy to use is provided.

Further, since the marks **374** indicating the sheet sizes are formed on the arm **37**, while the arm **37** is forwardly slid towards a user, the end guide **38** is aligned with the corresponding mark **374**, so that small sheets is easily settable to predetermined positions.

Although the image forming apparatus according to the exemplary embodiment is described using an electrophotographic image forming apparatus as an example, the present

invention is applicable to other types of image forming apparatuses including image forming units, such as inkjet image forming units.

The foregoing description of the exemplary embodiment of the present invention has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obviously, many modifications and variations will be apparent to practitioners skilled in the art. The embodiment was chosen and described in order to best explain the principles of the invention and its practical applications, thereby enabling others skilled in the art to understand the invention for various embodiments and with the various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims and their equivalents.

What is claimed is:

1. A feeding device comprising:

a body having a first sheet placement surface on which a sheet that is to be fed is placed;

a cover rotatably provided at the body, the cover having a second sheet placement surface capable of supporting a back edge portion in a feeding direction of the sheet when the cover is open, the cover being provided with a rotary shaft, the sheet being placed on the first sheet placement surface;

a moving member provided at the first sheet placement surface so as to be movable in line with the first sheet placement surface in a direction that is parallel to the feeding direction;

a linking member extending in a direction of movement of the moving member from the moving member, one end portion of the linking member being rotatably linked to the moving member using a second rotary shaft that is parallel to the rotary shaft of the cover; and

a sheet back-edge regulating member provided at the linking member so as to be movable in the direction of movement of the moving member, the sheet back-edge regulating member regulating a back edge in the feeding direction of the sheet placed on the first sheet placement surface,

wherein the first sheet placement surface has a first engaging section extending in the direction of movement of the moving member,

wherein the moving member has a first engaging pawl that is capable of engaging the first engaging section,

wherein the linking member has a second engaging section extending in a longitudinal direction of the linking member,

wherein the sheet back-edge regulating section has a second engaging pawl and an engaging pawl disengaging unit, the second engaging pawl being capable of engaging the second engaging section, the engaging pawl disengaging unit disengaging the second engaging pawl from the second engaging section, and

wherein a force that causes the second engaging pawl to engage the second engaging section is stronger than a force that causes the first engaging pawl to engage the first engaging section.

2. The feeding device according to claim **1**, further comprising a gripping section provided at another end portion of the linking member opposite to the one end portion of the linking member.

3. The feeding device according to claim **2**, wherein a surface of the another end portion of the linking member facing the cover is formed into a curved surface that is in accordance with a direction of rotation of the linking member.

4. The feeding device according to claim **1**, wherein the first sheet placement surface has a grooved portion in which the linking member extending in the direction of movement is disposed.

5. The feeding device according to claim **1**, wherein the engaging pawl disengaging unit includes a disengaging member that disengages the second engaging pawl from the second engaging section by moving in a direction of movement the sheet back-edge regulating section.

6. The feeding device according to claim **1**, wherein the linking member has a sheet size indicator that is in correspondence with the back edge of the sheet.

7. An image forming apparatus comprising:

an image forming section that forms an image; and

the feeding device of claim **1**.

8. The feeding device according to claim **1**, wherein the first sheet placement surface has a grooved portion,

wherein the linking member is configured to be disposed in the grooved portion, if the moving member is disposed at a frontmost position in the direction that is parallel to the feeding direction, and

wherein the linking member is configured to be drawn out of the grooved portion, if the moving member is disposed at a backmost position in the direction that is parallel to the feeding direction.

9. The feeding device according to claim **1**, wherein a length of the linking member in the direction of movement of the moving member is longer than a length of the cover in the direction of movement of the moving member.

10. A feeding device comprising:

a body having a first sheet placement surface on which a sheet that is to be fed is placed;

a cover rotatably provided at the body, the cover having a second sheet placement surface capable of supporting a back edge portion in a feeding direction of the sheet when the cover is open, the cover being provided with a rotary shaft, the sheet being placed on the first sheet placement surface;

a moving member provided at the first sheet placement surface so as to be movable in line with the first sheet placement surface in a direction that is parallel to the feeding direction;

a linking member extending in a direction of movement of the moving member from the moving member, one end portion of the linking member being rotatably linked to the moving member using a second rotary shaft that is parallel to the rotary shaft of the cover; and

a sheet back-edge regulating member provided at the linking member so as to be movable in the direction of movement of the moving member, the sheet back-edge regulating member regulating a back edge in the feeding direction of the sheet placed on the first sheet placement surface

wherein the linking member is configured to extend to a drawn-out position wherein the linking member extends across an entire length of the cover in the direction of movement of the moving member, if the moving member is disposed at a backmost position in the direction that is parallel to the feeding direction, and

wherein the linking member is configured to rotate upward from the drawn-out position, along with the cover, with the second rotary shaft as a fulcrum, as the cover is moved from an open position to a closed position.

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